MEMORANDUM

FROM: Jennifer Sukow, IDWR

TO: ESHMC

DATE: November 17, 2011

RE: Transient Spring Targets for Thousand Springs Cell and National Fish Hatchery Cell

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During the October 27, 2011 ESHMC meeting, the committee discussed scaling factors used to account for ungaged spring discharge in the two model cells that contain Thousand Springs, Magic Springs, and the National Fish Hatchery. Thousand Springs is located in model cell 1044012 and the National Fish Hatchery is located in model cell 1043012. The Magic Springs complex, which is diverted by the SeaPac Hatchery and the Brailsford Pipeline, is located in both model cells. Figures 1, 2, and 5 show the general locations of the facilities and springs with respect to ESPAM2.0 model cells.

During the October 27, 2011 meeting, the committee requested that the scaling factors be adjusted to reflect less ungaged flow in the National Fish Hatchery cell and more ungaged flow in the Thousand Springs cell. This memorandum describes data reviewed for these cells, and provides revised transient data series for use as calibration targets.

Figure 1. General location of facilities in model cells 1043012 and 1044012.

Thousand Springs Cell

The “Thousand Springs cell” contains the following springs (Figure 2).

- Ten Springs (diverted by Ten Springs Hatchery)
- Snowbank and Thousand Springs (diverted by Idaho Power)
- Spring partially diverted for irrigation on Ritter Island (“Ritter Island Spring”)
- Minnie Miller and unnamed spring (both unused)
- Bridal Veil and Hatchery Springs (diverted by SeaPac Hatchery)

Ten Springs is actually located at the edge of the adjacent model cell, but was included in the Thousand Springs cell because it located along the same geologic contact as Snowbank and Thousand Springs and is only about 200 feet from the cell boundary.

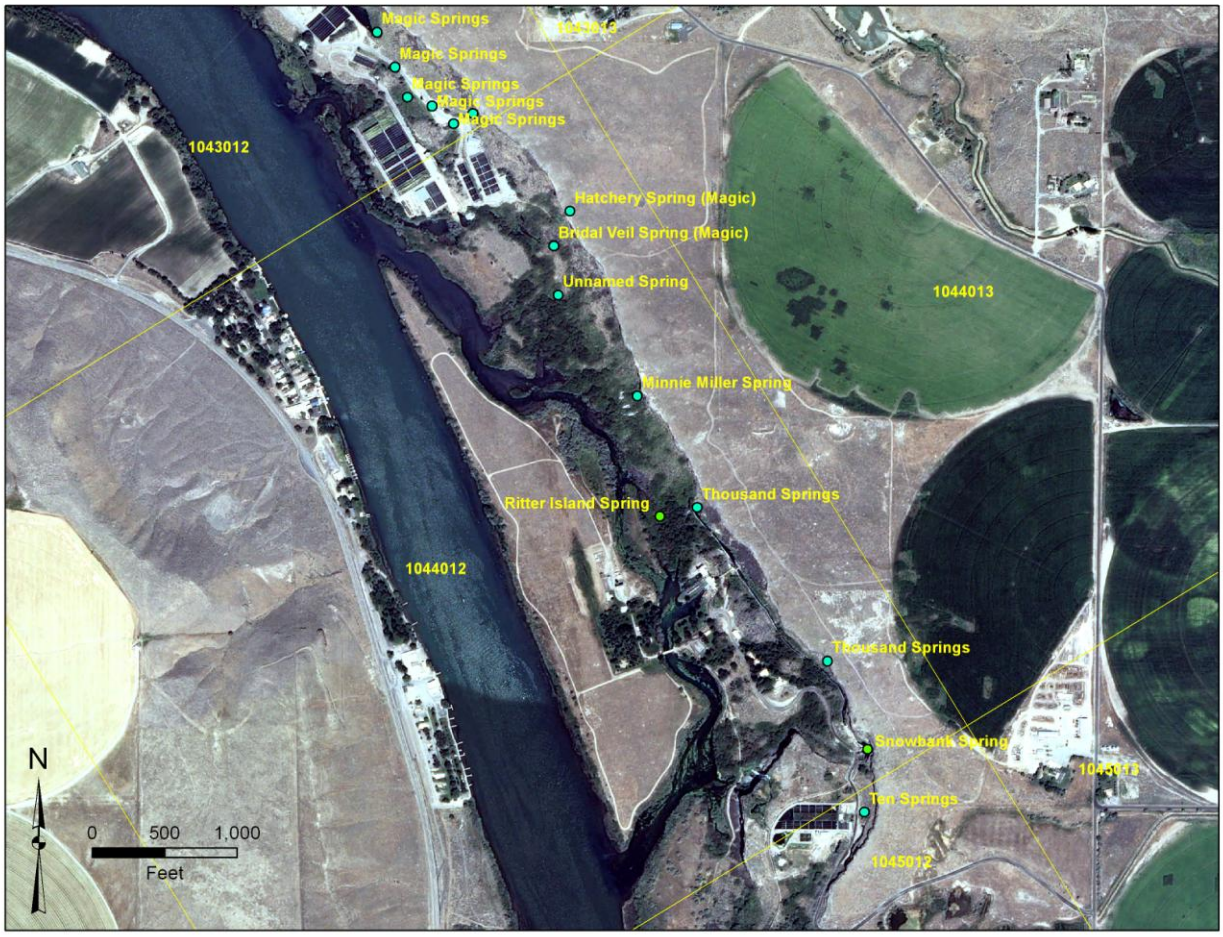

Figure 2. General location of springs in model cell 1044012.

Available diversion records between 1980 and 2008 are summarized in Table 1**.** Most of the available data were measured by the water users. Ungaged flow is known to discharge from Minnie Miller Spring, the unnamed spring, and the Ritter Island Spring, but is difficult to quantify. Covington and Weaver (1990) visually classified the flow at Minnie Miller Spring and the unnamed spring as greater than 10 cfs each. Chuck Brockway indicated there is not a good measurement section at Minnie Miller spring, and that it would be difficult to measure the discharge with confidence. Two instantaneous measurements collected at the Ritter Island Pipeline between 1998 and 2005 indicate that spring discharge was at least 2 cfs.

Site	Dates	Frequency
Ten Springs Hatchery (IDWR Site ID 360410088)	3/1995 – 12/2010	Weekly
Thousand Springs Power Plant Total Flow (IPCO)	1/1995 – 1/2010	Monthly
Thousand Springs Power Plant from Sand Springs (IDWR Site ID 360410076)	1/1997 – 12/2010	Weekly
Ritter Island Pipeline	9/30/1998; 4/18/2002; 5/27/2003; 5/19/2005; 9/27/2011 1999 - 2010	Miscellaneous Annual volume
Undiverted flow at Ritter Island Spring	Not measured	Not measured
Minnie Miller	Not measured, no diversions	Not measured
Unnamed Spring	Not measured, no diversions	Not measured
Bridal Veil Spring (part of Magic Spring Hatchery)	9/17/2010; 11/19/2010; 5/20/2011; 8/31/2011 9/2010 – 8/2011	Miscellaneous 15-minute (provisional)
Hatchery Spring (part of SeaPac Hatchery)	Not measured separately	Not measured separately
SeaPac Hatchery (IDWR Site ID 360410080)	3/1995 – 12/2010	Weekly or Monthly

Table 1. Available diversion records for calculation of spring discharge in the Thousand Springs cell.

Previous scaling calculations assumed 20 cfs of ungaged flow at Minnie Miller and the unnamed springs. Based on discussions with Ken Ashley and Chuck Brockway during the October 27, 2011 meeting, the committee agreed that 45 to 50 cfs was likely a better representation of the ungaged flow in this cell and that there is considerable uncertainty in this assumption. Calculation of a scaling factor to account for ungaged flow at Minnie Miller, unnamed, and Ritter Island Springs is shown in Table 2.

Transient data for the Ten Springs Hatchery diversion, the power plant diversion from Thousand Springs, and total SeaPac Hatchery diversions are shown in Figure 3. Both the Ten Springs and SeaPac Hatchery data series exhibit different trends than the data obtained from the power plant. The trends of the transient data series from the hatcheries do not appear to be suitable for direct use in the ESPAM2.0 calibration target. The reported Tens Spring Hatchery diversions appear to be unusually low between April 1995 and November 1995, and unusually high between the summer of 2002 and winter of 2003. The reported SeaPac diversions have significantly lower seasonal amplitude prior to 2002, and have unexplained high values in 2003, 2005, and 2006 that are not characteristic of records for either Thousand Springs or the neighboring National Fish Hatchery spring complex. If additional data or information become available to the ESHMC, further examination of diversion data from these facilities might facilitate direct use of transient data in future calibrations of the model (ESPAM2.1 or later). The transient data from the Ten Springs and SeaPac hatcheries were used to calculate an average ratio of hatchery diversions to the power plant diversions. The average ratios were used in the scaling factor calculation summarized in Table 2.

Spring	Scaling Factor	Portion of Cell Discharge	Comments
Ten Springs	0.070	5.6%	Average ratio (Ten Springs Hatchery/ power plant from Thousand Springs)
Thousand Springs	1.000	79.4%	Transient data series used as basis for calibration target
Minnie Miller and unnamed spring	0.100	7.9%	50 cfs/500 cfs
Ritter Island Spring	0.004	0.3%	2 cfs/500 cfs
SeaPac diversions from Bridal Veil and Hatchery Springs	0.085	6.8%	Average ratio (34% of SeaPac Hatchery/power plant from Thousand Springs)
Scaling factor	1.259	100%	Sum of spring scaling factors

Table 2. Calculation of scaling factor for Thousand Springs cell.

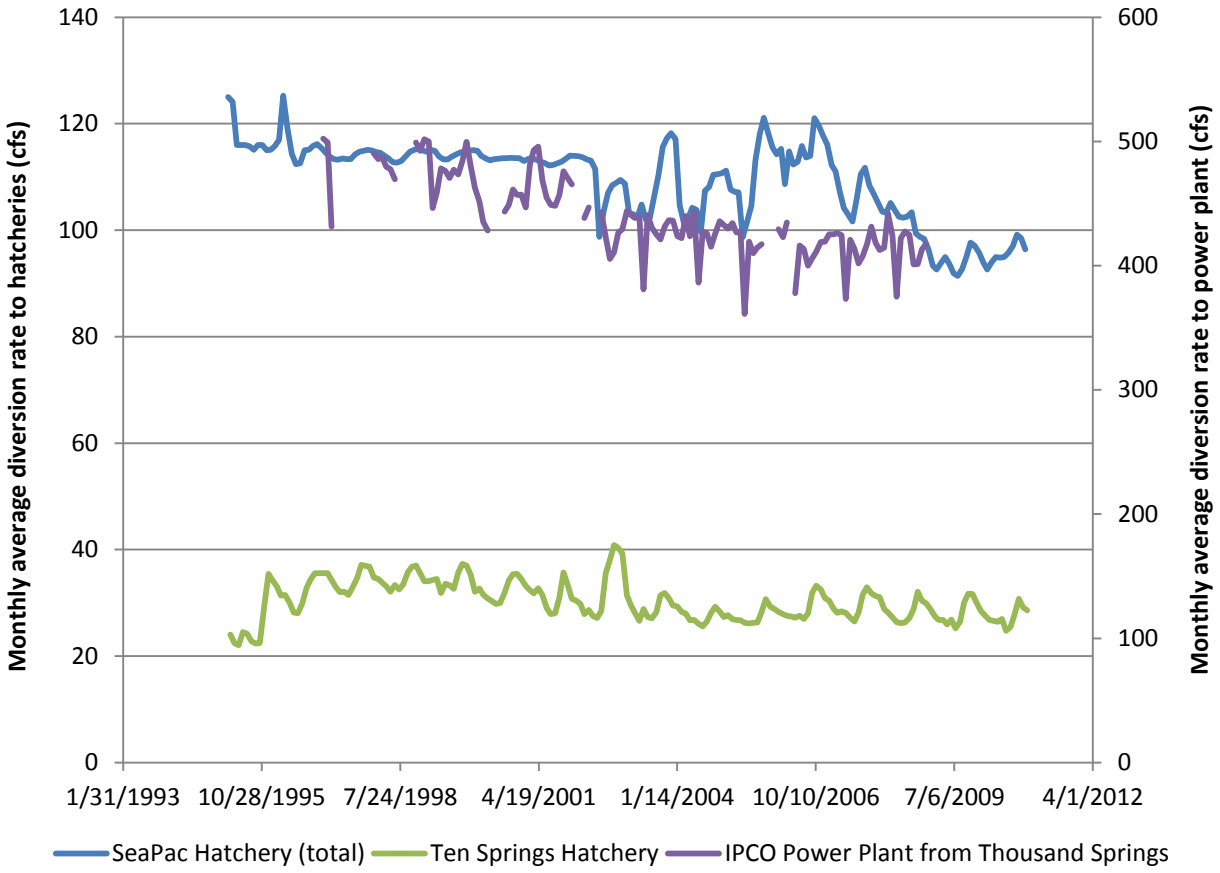

Figure 3. Transient data for Ten Springs and SeaPac hatcheries, and power plant diversions from Thousand Springs.

The SeaPac Hatchery diverts from springs located in both the Thousand Springs cell (1044012) and the National Fish Hatchery cell (1043012). SeaPac measures total hatchery water use and reports the total to IDWR. Bridal Veil Spring and Hatchery Spring are located in the Thousand Springs cell. IDWR began gaging flow at Bridal Veil Spring in September 2010. Flow at the Hatchery Spring is not measured separately, but is reported to be approximately 3-4 cfs (Koreny, 2011[1]). The ratio of total Seapac diversions from Bridal Veil and Hatchery Springs was estimated using three current meter measurements above Bridal Veil Falls performed by IDWR between September 2010 and May 2011. A discharge of 3 cfs was assumed at Hatchery Spring. Based on these data, approximately 34% of the SeaPac Hatchery's total diversions are from Bridal Veil and Hatchery Springs in the Thousand Springs model cell and approximately 66% are from springs in the National Fish Hatchery model cell. This ratio was applied to historic data to estimate the contribution of SeaPac diversions to discharge in each model cell.

[1] Koreny, J.S., 2011. E-mail from John Koreny to Allan Wylie, FW: Magic Springs Flow Data, October 26, 2011.

The proposed calibration target for ESPAM2.0 is shown in Figure 4. The calibration target for the Thousand Springs model cell is calculated as follows.

Thousand Springs cell discharge = 1.259 * (Total Thousand Springs Power Plant diversions – power plant diversions from Sand Springs)

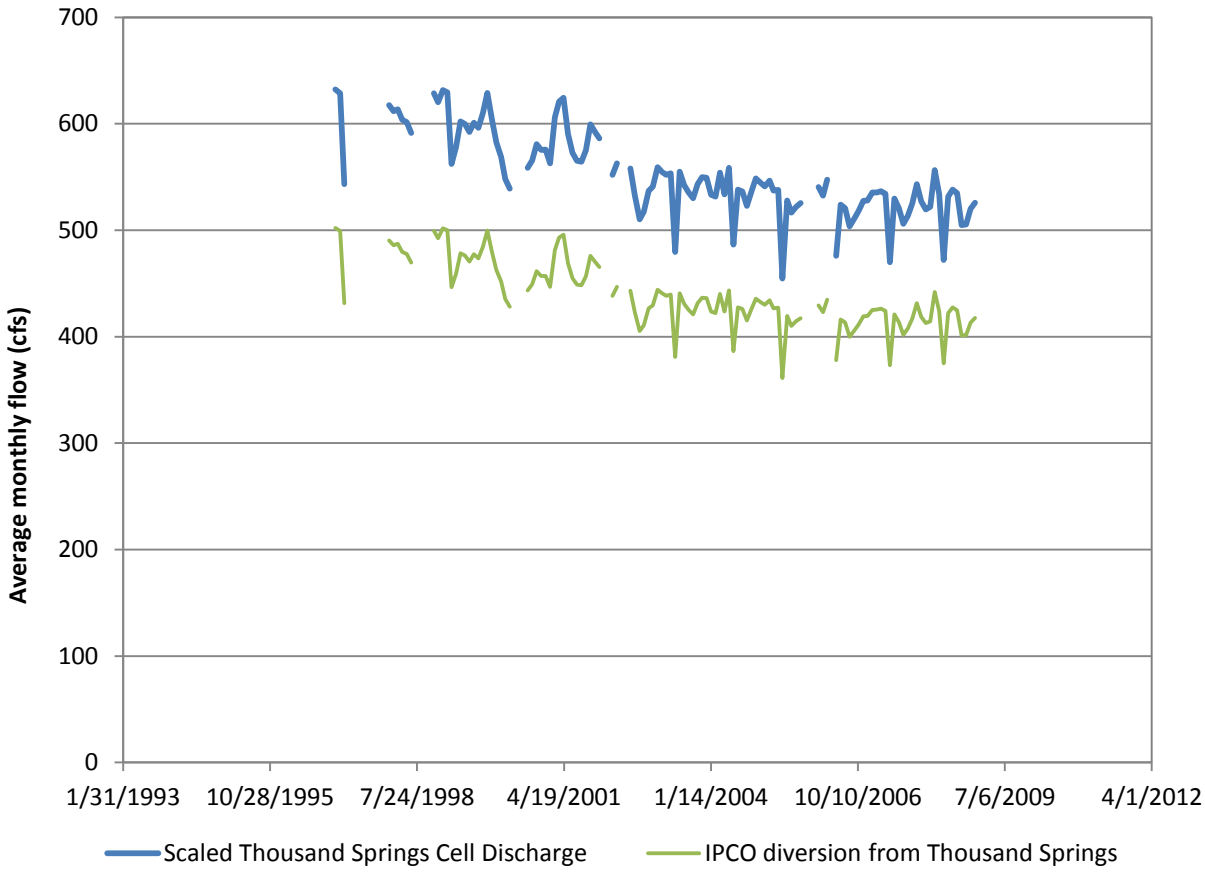

Figure 4. Estimated spring discharge in Thousand Springs model cell.

National Fish Hatchery Cell

The “National Fish Hatchery Cell” contains the following springs (Figure 5).

- ABC and six other springs in Magic Springs complex (diverted by SeaPac Hatchery)
- Brailsford Pipeline diversion and overflow from Magic Springs complex
- Domestic diversion from Magic Springs complex
- Unnamed spring
- National Fish Hatchery complex (sum of 8 user-reported measurements)

Figure 5. General location of springs in model cell 1043012.

Available diversion records between 1980 and 2008 are summarized in Table 3**.** Most of the available data were measured by the water users. Ungaged flow includes overflow at the Brailsford Pipeline, the domestic diversion, and the unnamed spring. Peak month diversions reported at the Brailsford Pipeline range from 7.3 to 9.6 cfs. Unmeasured water overflows to the Snake River when the pipeline is not diverting.

Site	Dates	Frequency
ABC Springs (part of SeaPac Hatchery)	3/2009 – 9/2011	Miscellaneous
Other springs (part of SeaPac Hatchery)	Not measured separately	None
SeaPac Hatchery (IDWR Site ID 360410080)	3/1995 – 12/2010	Weekly
Brailsford Pipeline (IDWR Site ID 360410216)	1/1999 – 12/2010	Weekly
Undiverted flow at Brailsford Pipeline	Not measured	None
Domestic diversion	Not measured	None
Unnamed spring	Not measured, no diversions	None
Bickel and Riley Springs (part of National Fish Hatchery complex)	8/1965 – 2/2010	Weekly
National Fish Hatchery complex	1/1993 – 2/2010	Weekly

Table 3. Available diversion records for calculation of spring discharge in the National Fish Hatchery cell.

Domestic diversions from the Magic Springs complex are believed to be negligible. The domestic water right is licensed for 0.04 cfs. The unnamed spring is not measured, and is located along a Northside Canal Company wasteway. Ken Ashley told the ESHMC that the unnamed spring flows roughly 0.5 cfs when the wasteway is not contributing to the flow. Calculation of a scaling factor to account for ungaged flow in the National Fish Hatchery cell is shown in Table 4.

Spring	Scaling Factor	Portion of Cell Discharge	Comments
SeaPac diversions from ABC and other Magic Springs in cell	0.924	45.1%	Average ratio (66% of SeaPac Hatchery/National Fish Hatchery diversions)
Brailsford Pipeline diversions and overflow	0.118	5.8%	9.55 cfs/81.01 cfs in June 1999
Domestic diversion	0.0005	0.0%	0.04 cfs/80 cfs
Unnamed spring	0.006	0.3%	0.5 cfs/80 cfs
National Fish Hatchery complex	1.000	48.8%	Transient data series used as basis for calibration target. (Prior to 1993 estimated from Bickel and Riley * 3.477)
Scaling factor	2.049	100%	Sum of spring scaling factors

Table 4. Calculation of scaling factor for National Fish Hatchery model cell.

Transient data for total SeaPac Hatchery diversions and the National Fish Hatchery complex are shown in Figure 6. The SeaPac Hatchery data series exhibits a different trend than the data obtained from the National Fish Hatchery. The seasonal amplitude between July 1996 and May 2002 appears to be similar the National Fish Hatchery record, but after May 2002, the seasonal amplitude and annual variations are much greater. The SeaPac Hatchery diverts from springs with elevations that are generally similar to, or lower than, the National Fish Hatchery springs. Therefore, the seasonal amplitude and annual variation in spring discharge at the Magic Springs complex is expected be similar to, or less than, that observed at the National Fish Hatchery springs. The trend of the transient data series from the SeaPac Hatchery does not appear to be suitable for use in the ESPAM2.0 calibration target. If additional data or information become available to the ESHMC, further examination of diversion data from this facility might facilitate direct use of transient data in future calibrations of the model (ESPAM2.1 or later). The transient data were used to calculate average ratio of the Magic Springs data to the National Fish Hatchery data. The average ratio was used in the scaling factor calculation summarized in Table 4.

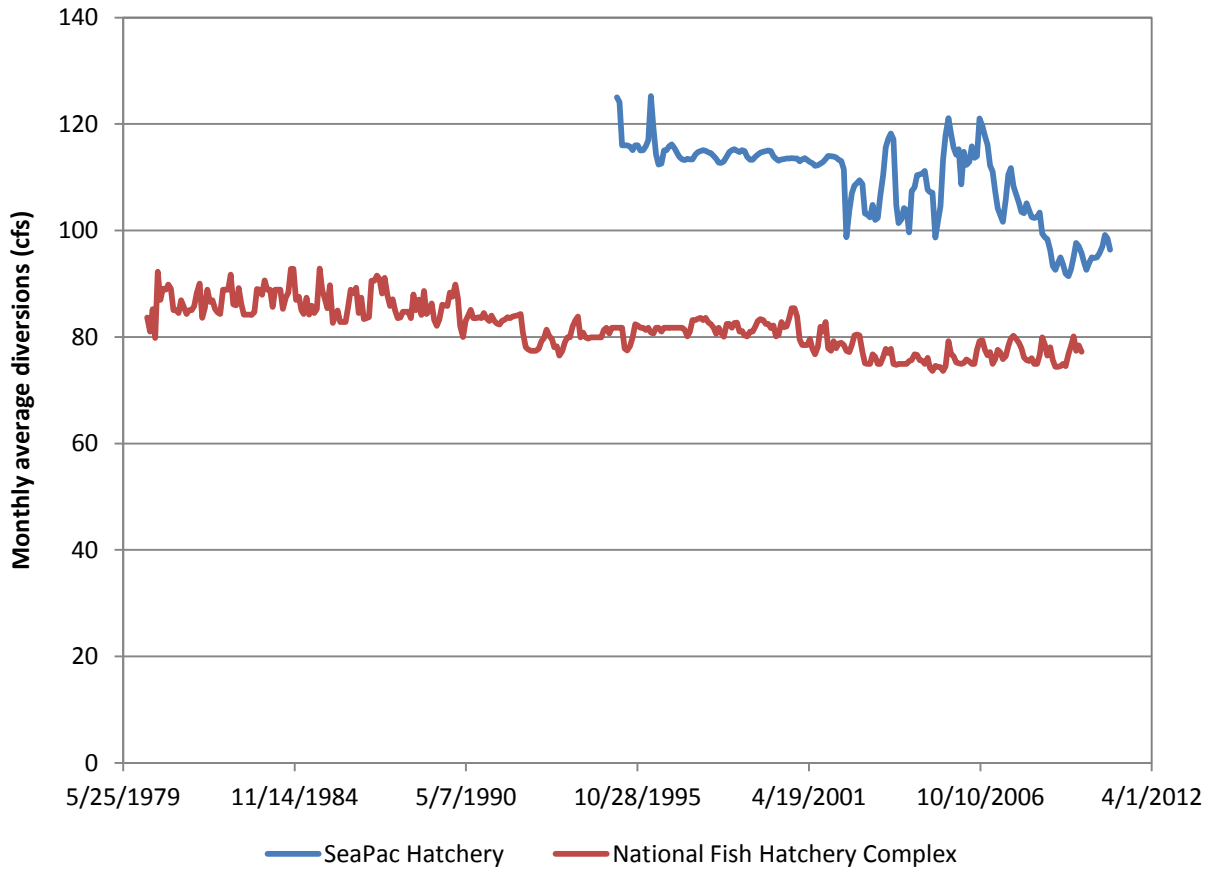

Figure 6. Transient data series for total SeaPac Hatchery and National Fish Hatchery diversions.

Estimated spring discharge (Figure 7) within the National Fish Hatchery model cell was calculated for the time period between January 1993 and October 2008 using the following equation.

National Fish Hatchery cell discharge = Total National Fish Hatchery diversions * 2.049

Prior to 1993, measurements were only recorded for Bickel and Riley Springs. Estimated spring discharge between March 1980 and December 1992 was calculated using the following equation.

National Fish Hatchery cell discharge = Bickel and Riley Springs * 3.477 * 2.049

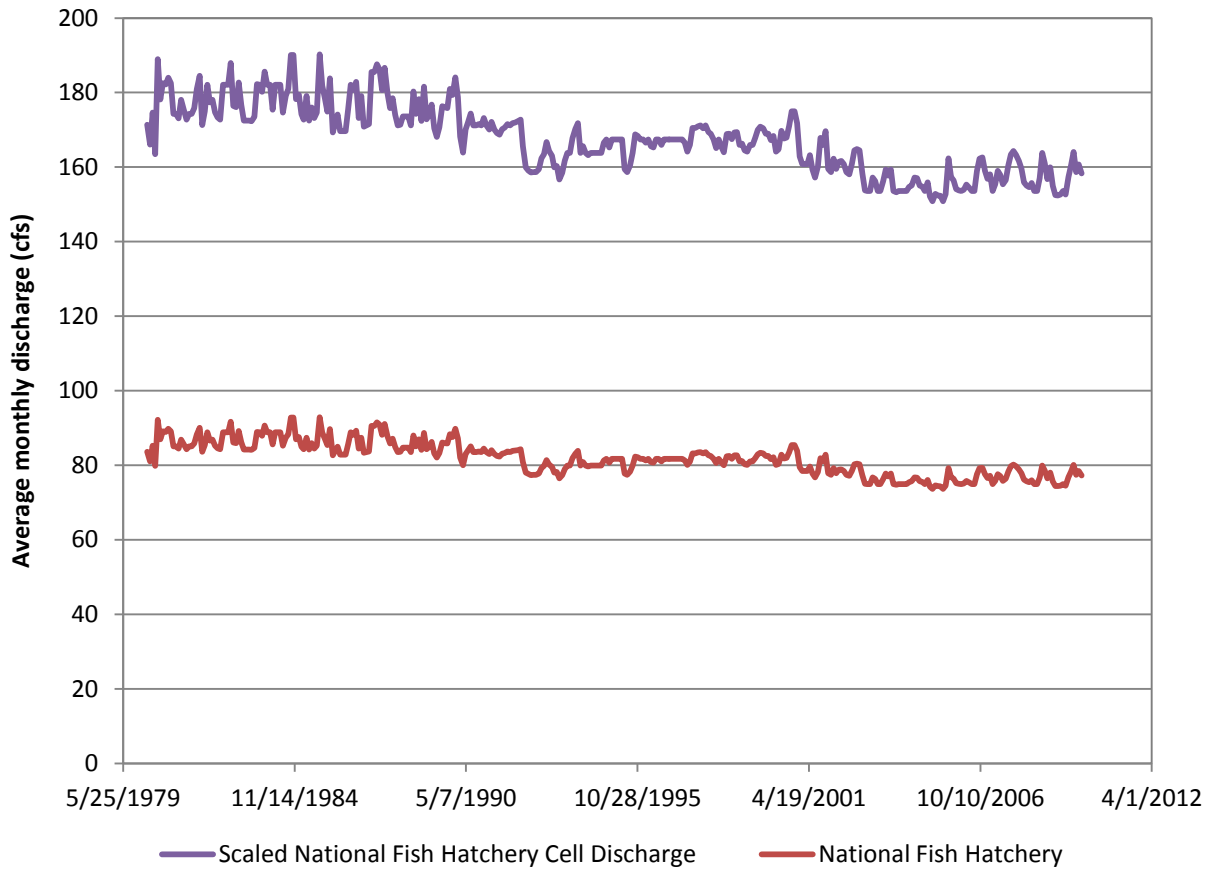

Figure 7. Estimated spring discharge in National Fish Hatchery model cell.

ESPAM2.0 Calibration Targets

Figure 8 compares the ESPAM2.0 calibration targets for the Thousand Springs and National Fish Hatchery model cells. The Thousand Springs cell target declines more steeply than the National Fish Hatchery cell target. This may be because a large portion of the discharge in this cell occurs from the Thousand Springs at an elevation of greater than 3,050 feet (Covington and Weaver, 1990[2]). The National Fish Hatchery cell appears to have more discharge from lower elevation drains. Most of the springs in the Magic Springs complex and two of the springs in the National Fish Hatchery complex have mapped elevations less than 3,000 feet (Covington and Weaver, 1990[3]).

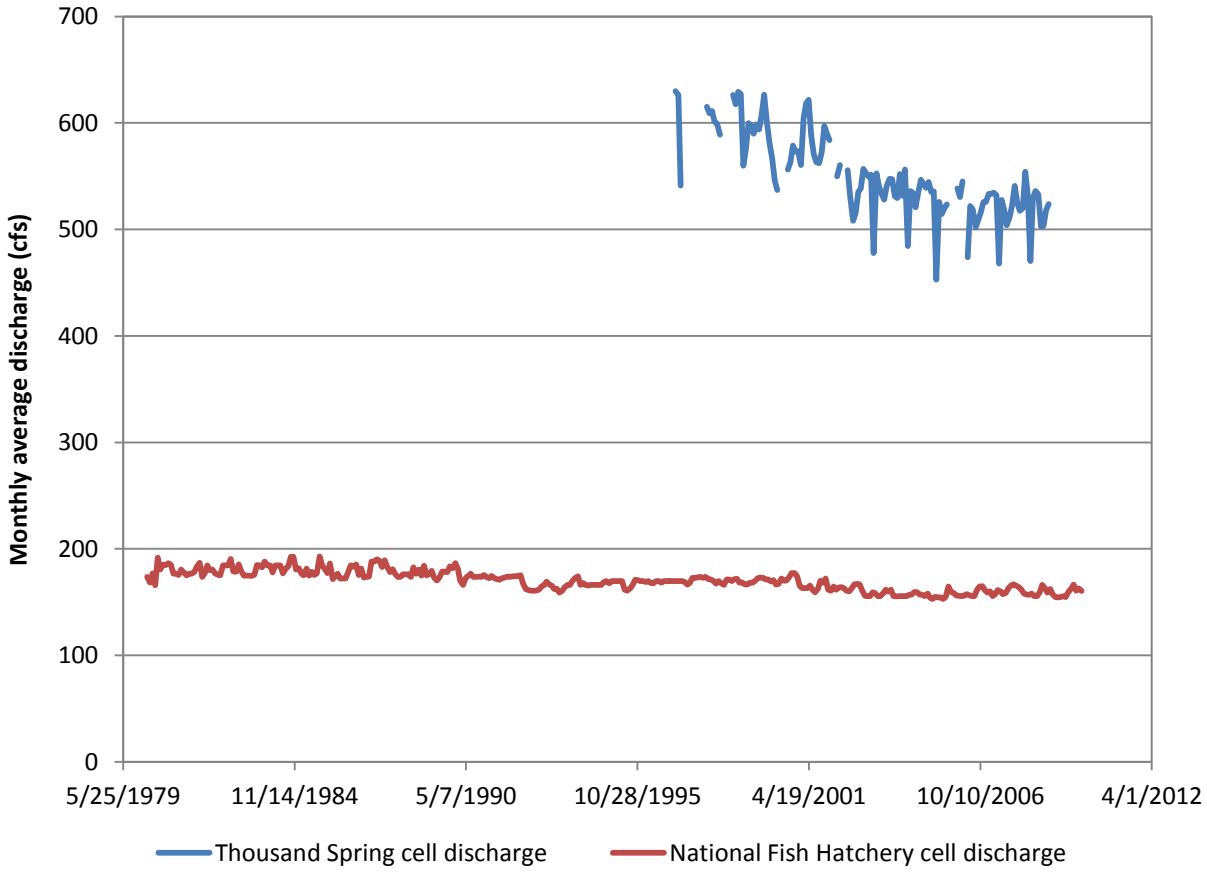

Figure 8. Calibration targets for ESPAM2.0.

[2] Covington, H.R., and J.N. Weaver, 1990. *Geologic map and profiles of the north wall of the Snake River Canyon, Thousand Springs and Niagara quadrangles, Idaho*, USGS Miscellaneous Investigations Series Map I-1947-C.

[3] Covington, H.R., and J.N. Weaver, 1990. *Geologic map and profiles of the north wall of the Snake River Canyon, Bliss, Hagerman, and Tuttle quadrangles, Idaho*, USGS Miscellaneous Investigations Series Map I-1947-A.